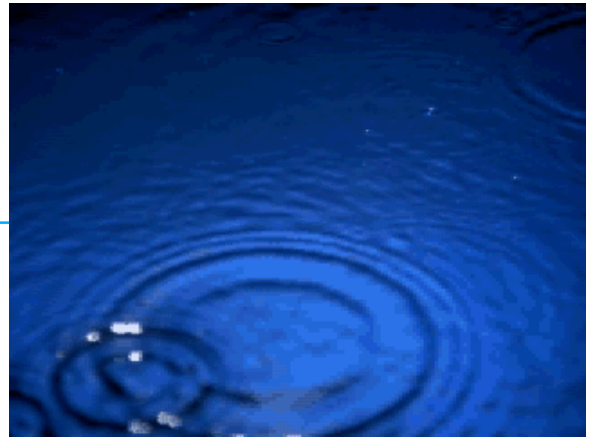
GPM

GLOBAL PRECIPITATION MEASUREMENT

GPM
Global Precipitation Measurement



Integrated Hydrological Validation

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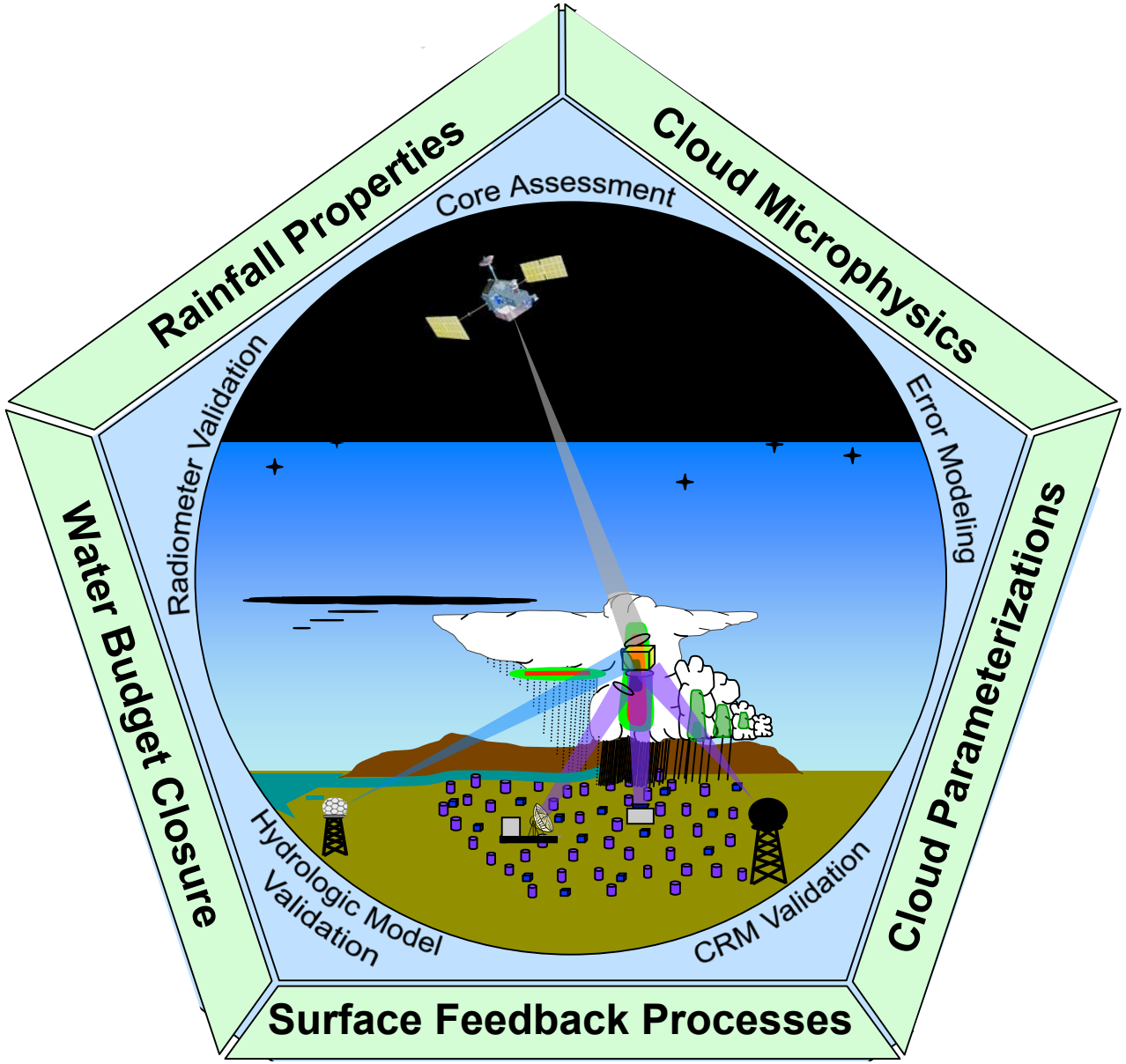
Integrated Validation Concept



Integrated Validation Questions

- *What is (are) the most effective way(s) to test the utility of satellite rainfall retrievals in hydrological applications?*
- *Is there a temporal or spatial scale below which it is simply not practical to worry about "validation" of the GPM satellite obs in the hydrologic realm?*
- *How do the results of integrated or hydrologic validation feedback to retrieval algorithms?*
- *Coupled CRM/LSM and Hydrologic models are likely to be a key player here- how good do they have to be? i.e., is there some minimal suite of parameters/processes that must be represented in order for the models to be considered as an integrated GV tool?*

Integrated Validation Recommendations

- *Key approach is to study the propagation of precipitation errors through land surface and/or hydrological models (including quantifying the errors in the models themselves), subject to water and energy budget constraints.*
- *Several ongoing international efforts on land surface and hydrological modeling could become basis for cooperative PMM proposals, e.g., S. America, Europe, Asia*
- *Integrated hydrological validation is NOT a one-way flow of information—the land surface constrains the PBL and regime, esp. for orographic and weakly forced convective situations*
- *Would like to consider developing several international collaborations on integrated validation, possibly including the production of "country-specific" or "continent-specific" blended products*

Integrated Validation Issues

- ***Need to consider and evaluate different time/space scales for applications :***
  - *Flash floods (saturation excess vs. infiltration excess)*
  - *Large river flows (daily/monthly)*
  - *Water cycle (soil moisture, ET, droughts)*
  - *Water management (snow melt, reservoirs, warnings)*
- ***Not all validation activities will be integrated. However, certain sites should be augmented with water and energy flux and state measurements to provide additional constraints on the retrievals and evaluate approaches for adding value to retrievals (e.g., gauge correction, blending, downscaling)***
- ***Integrated validation sites should be selected with scale/process considerations above***

- *Backup slides*

GPM Applications & Validation

- *Applications* - Making GPM data products and resources accessible to users and stakeholders beyond the traditional precipitation science community - by establishing broader and more effective use of space-based precipitation data products in decision-support of a wide variety of societal applications
  - Freshwater Utilization and Resource Management
  - Natural Hazard Monitoring/Prediction (Flood Warnings, Hurricane and Cyclone Observation, Winter Weather Events)
  - Operational Weather Forecasting
  - Climate Change Assessment
  - Agriculture
  - Transportation
  - Policy and Planning

- *Validation* - Ground Measurement Advisory Panel recommends:
  - *Surface precipitation statistical validation sites* for direct assessment of GPM satellite data products
  - *Precipitation process sites* for improving understanding of precipitation physics, modeling, and satellite retrieval algorithms
  - *Integrated hydrological sites* for improving hydrological applications

Integrated Validation Concept

•High fidelity Land Surface model simulations are seen as a vital part to improving our understanding of emissivity models that must ultimately become part of physical radiometer algorithms over land.

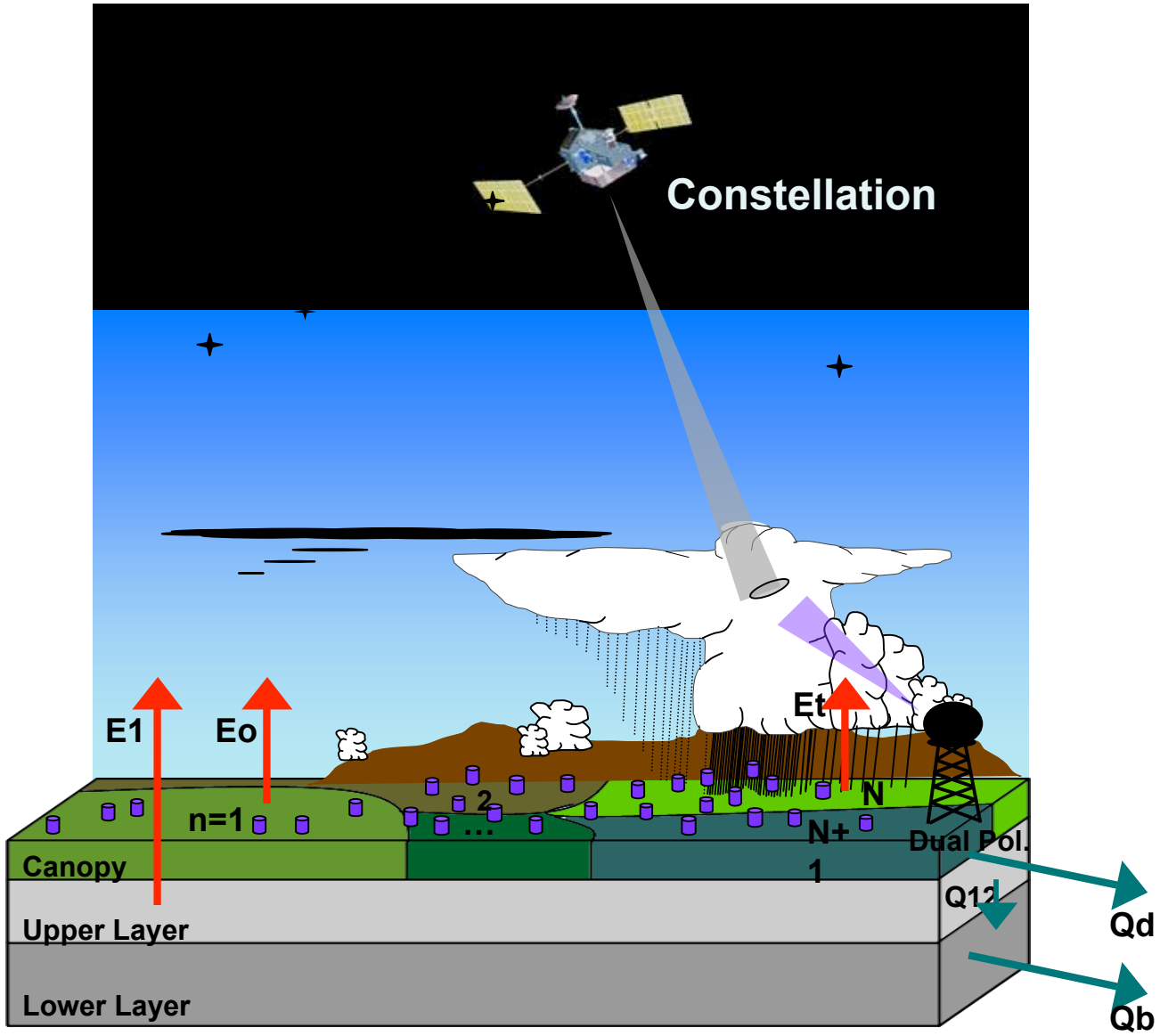
•Coupled Land Surface/Cloud Resolving Models must be viewed as an integral part of any applications paradigm that focuses on the 2010-2020 time frame. Progress in data assimilation will surely expand to these scales.

•Land surface hydrologic models offer a unique validation perspective that allows the regional closure of the water/energy cycle to be studied. Together with the CRM validation and the infrastructure needed for it, this offers a new and integrated look at rainfall validation that complements the more direct comparisons.

•Validating Coupled Land Surface/Cloud Resolving Models requires only marginal additional observations over those planned for GPR Core Satellite Quality Assessment and Error Modeling

•Actions: Add surface flux, soil moisture/temperature profiles and run-off observations to potential validation sites

Integrated Validation Concept



Integrated Validation Opportunities

- ***North America: Q2***
  - *U.S./NOAA: HMT*
  - *Canada/EC: C3VP, Radar network, PEARL site, Whistler Olympic site*
- ***South America:***
  - *Brazil: INPE, Paraiba do Sul watershed (very well instrumented)*
  - *La Plata: Extensive hydrological observations. No radars*
  - *Ecuador: Hydrological validation site (Nested met model – 30m hydrology model inside a nested regional model (MM5?) SVAT-CLM+regCM model in watershed (name?); experimental x-band radar+climate stations&present weather sensor*
  - *Associated Program on Flood Management (www.apfm.info)*
  - *PROHIMET (www.prohimet.org)*

Integrated Validation Opportunities

- ***Europe: OPERA (www.knmi.nl/opera); FLOODsite (FP6); HYDRATE (FP6)—flash flood database; EWASE (FP6)***
  - *UK: National radar/gauge network, UK Met Office*
  - *Finland/FMI: Several work packages in place: snowfall, SWE*
  - *France/IPSL: National radar/raingauge network*
  - *Italy: Rome site +national radar/raingauge network*
  - *Netherlands: CESAR Physical validation site*
  - *Spain: National radar network; Catalunya (Catalan National Network); Besos testbed nr Barcelona (1015km2) Dichitop R-R model (Corral 2004) EHIMI project*
  - *Germany: Linden Site nr Marburg (Physical Validation); DLR Bonn& Lindenberg; Natl Radar network/DWD (will be polarized in 2011) H-SAF facility*
  - *Greece/Europe: HOnet (Hydrologic observatory network for Europ/Jenkins >2000km2)*
  - *HYDRATE (flash flood <500km2 HOs)*
  - *Israel:*
- ***Australia/BM: National radar network, Darwin site***
- ***Africa: AMMA datasets, including ALMIP***
- ***Asia:***
  - *Japan/JAXA:*
  - *India:*

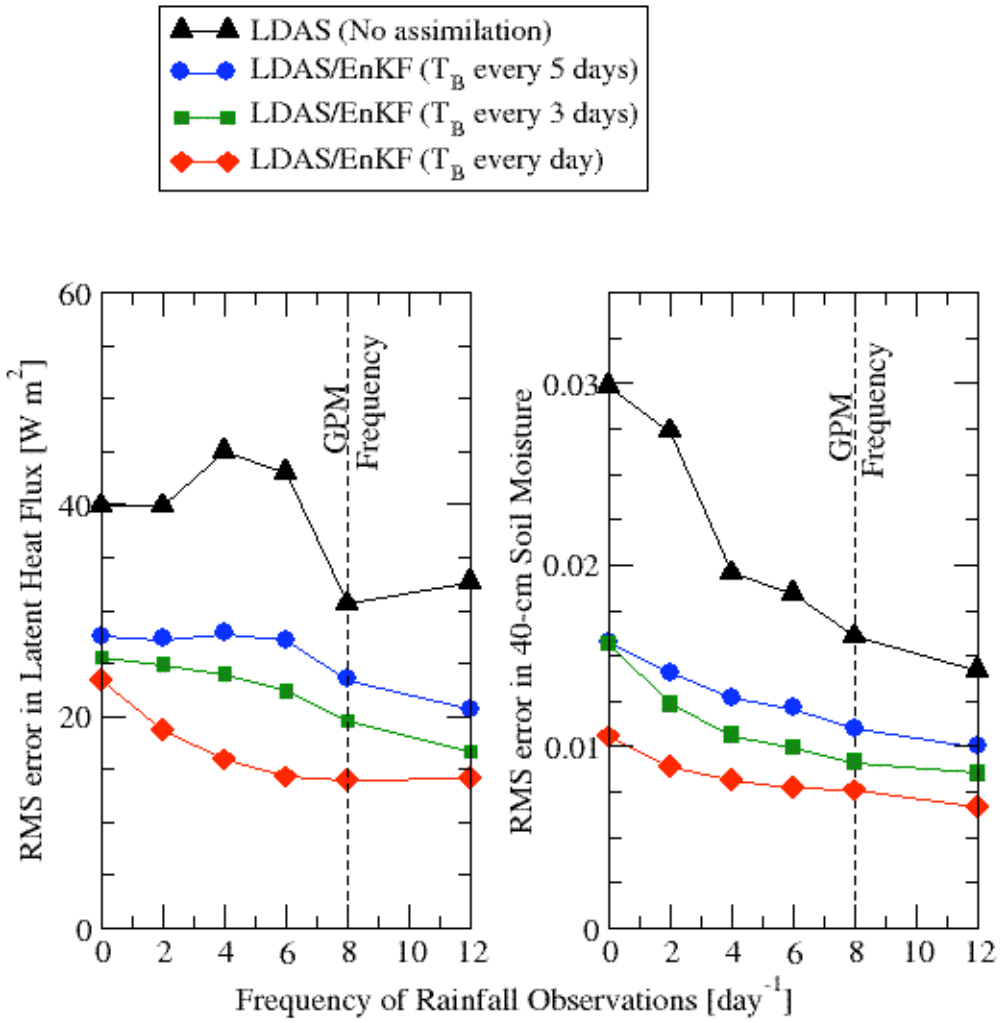
Integrated Validation Discussion

- *Objectives: get from Manos slides*
- *Questions: get from Manos slides*
- *Discussion: How can PMM team help/collaborate on "applications"?*
- *Need to remember that integrated validation includes water, energy fluxes, and water budget closure constraints.*
- *Different space/time scales: Flash floods (complex terrain); large river flows(daily/monthly); water cycle (soil moisture/ET); water management (reservoir, warnings)*
- *Quality of the data: similar requirements to regional networks, physical validation*
- *Arthur: Integrated validation feeds back to level 3 and 4.*
- *Ana: example from Oklahoma—CAPE f(soil moisture). Need to look at column as a continuum.*
- *Some validation sites should include hydrologic validation as a component.*

GPM-SMAP Synergy

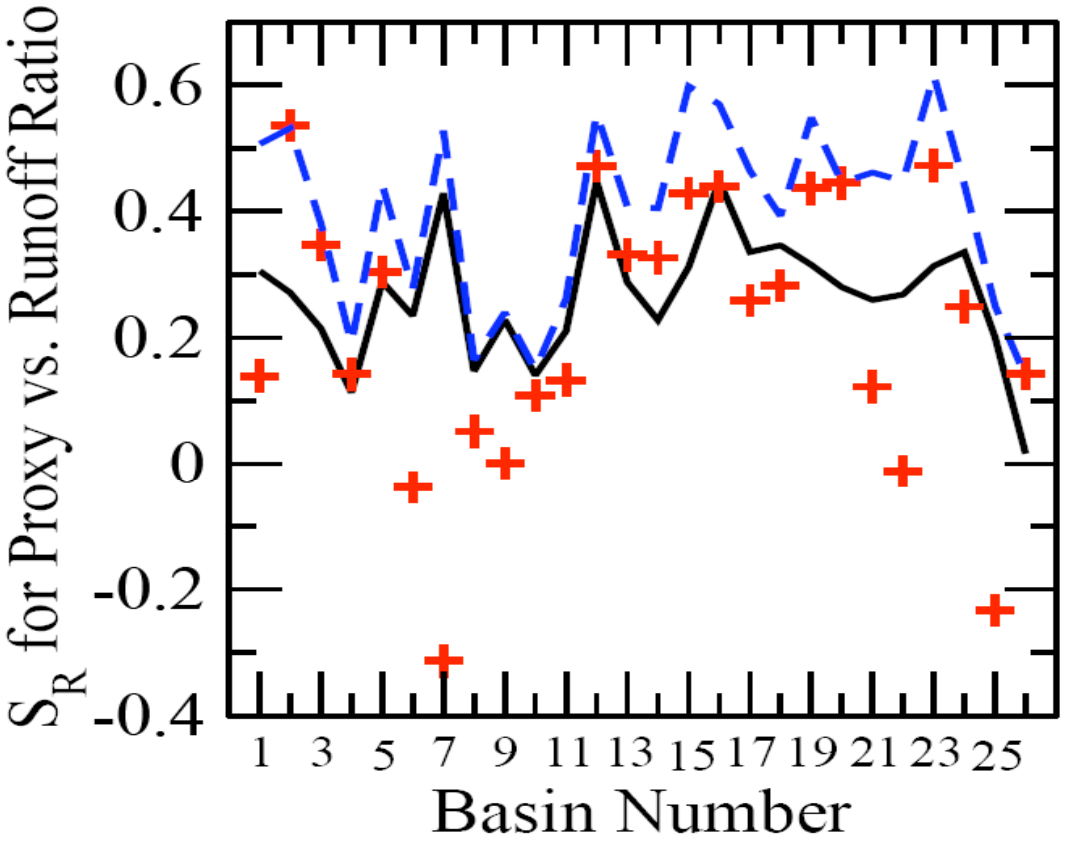
- *Understanding water and energy cycle linkages:*
  - *Non-parameterized estimation of closure function as in Salvucci, WRR, 2001*
- *Enhanced Land Surface Flux/State Forecasting:*
  - *SMAP Tb combined with GPM P should reduce flux/state errors as in Crow et al., EOS, 2006*
- *Enhanced Flood Forecasting:*
  - *SMAP Soil Moisture combined with GPM P should reduce flood forecasting errors as in Crow et al., 2005; Bindlish et al., 2007*
- *Independent Validation for GPM:*
  - *SMAP Soil Moisture assimilated into a simple model could provide an independent estimate of GPM errors in data-poor regions as in Crow and Bolten, 2007*
- *Improved surface emissivity characterization:*
  - *SMAP soil moisture, temperature and freeze/thaw products can improve representation of surface emissivities to help improve GPM PM retrievals. -*
- *GPM as a SMAP Input Source:*
  - *E.g., GMI 36.5GHz soil temperature and DPR Precipitation*

SMAP Tb combined with GPM P should reduce flux/state errors as in Crow et al., EOS, 2006



SMAP Soil Moisture combined with GPM P should reduce flood forecasting errors as in Crow et al., 2005; Bindlish et al., 2007

Red+=TMI only
Black=model only
Blue= assimilating TMI input model



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